Effect of mineral filler type and particle size on the engineering properties of stone mastic asphalt pavements

ABSTRACT

This study examines four types of industrial and by-product waste fillers, namely limestone dust (LSD), which was the reference filler; ceramic waste dust (CWD); coal fly ash (CFA), and steel slag mixture (SSD). The filler consisted of an aggregate (10% of total weight) with three proportions: 100% passing 75μm, 50% passing 75μm/20μm, and 100% passing 20μm. Comprehensive laboratory tests were performed to determine the impact of different types and particle sizes of fillers on the engineering and mechanical properties of fine mastics and stone mastic asphalt mixture. The results indicate that the application of industrial by-products used as fillers improves the engineering properties of stone mastic asphalt mixtures. The increased stiffness due to the addition of the filler is represented by an increase in the softening point, viscosity, stability, and resilient modulus, as well as a decrease in penetration. The optimum asphalt content increased with the decrease in filler particle size for LSD and SSD, and decreased for CWD and CFA. It was also determined that the filler type and particle size has a significant effect on the mixture properties. Among these three proportions, the samples prepared with the filler size proportion of 50/50 gave the best value in terms of stability, Marshall quotient, and resilient modulus than the other filler size proportions.

Keyword: Mineral fillers; Particle size; Stone mastic asphalt; Engineering properties